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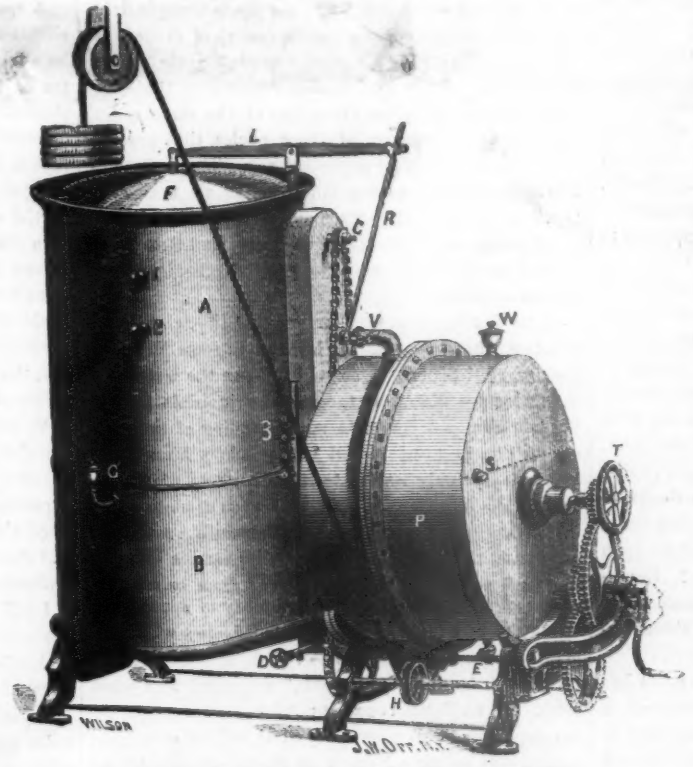
Empire State Gas Machine.

The operation of this machine is such, that the manufacture of gas is automatic, being controled by the quantity of gas consumed; or, in other words, the gas is generated in proportion to the number of burners employed, within the capacity of each respective sized machine, there never being any gas on hand excepting that in the pipes and fixtures.

The accompanying cut represents, very nearly, a front view of the machine. It consists of a meter or air pump (P). Tank (B) whi h contains the gasoline, and small gas holder, or regulator (F). The gearing (T) is actuatad by the weight and pulleys shown in the cut. The spindle (E) also carries the endless chain shown at C, which operates small buckets inside the vertical case, in the same manner, *i. e.*, by an endless chain. These buckets carry up the gasoline and distributes it upon inclined planes in tank (A), when it is subjected to the action of the air which becomes fully carburetted and is conveyed to regulator tank (F), when it is gas ready to distribute for illuminating purposes. Levers (L R) and valve are operated by the float (F), and automatically regulates the flow of air into the gas generator. The machine, being wound up by the crank, and the crank taken off, is ready for operation.

Further information may be had on application to Messrs. Nash & Cate, No. 29 Courtlandt street, N. Y.



EMPIRE STATE GAS MACHINE.

The New Steam Boiler.

A new invention has been so far perfected as to warrant its submission to the public for trial. Mr. Silas C. Salsbury, an old inventor and scientific student, has been devoting his attention untiringly in Germany and France to the development of a patent steam boiler, by which the following effects may be obtained: First, economy of fuel; second, saving of room; third, rendering an explosion impossible; fourth, preventing incrustation; fifth, rendering it impossible to overheat the fire surface: sixth, increasing the intensity of the gases. First, in regard to economy of fuel. By having the coldest water coming rapidly in contact in small quantities between the two hot plates under such a pressure as to cause a circulation from the main boiler to the water arch. This arch is surrounded on both sides by intense heat, and the circulation is increased in velocity just in proportion to the amount of heat in the furnace, by blast or otherwise; and as the circulation increases in velocity it brings the colder water in contact with the hot plates, which absorbs the heat as fast as produced, and the water so becomes highly heated. It is then discharged in the chamber above the water line in form of wet steam, and as it is driven in all directions among the tubes, they again supply the heat to fully prepare the steam dry for use. By this process an equalized temperature throughout all parts of the boiler is kept, absorbing all the heat as fast as it can be produced. There is a second chamber in which the carbonic oxyds are utilized and changed to carbonic gases, supplying an intense heat above the water arch and thence up through the main boiler, which gives a larger and intenser fire surface. The supply of hot water in the upper chambers of the main boiler (which is fitted with five feet two inch tubes) is so distributed in jets by contact throughout all the space above the water that overheating is impossible. The whistle is so connected with the lowest gauge cock that an alarm is given when the water reaches that point, and as it would take one and a half hours for the twenty inches below to evaporate, this length of time is given for escape from any possible danger. The space required for the boiler is less than one half of that of any other. Incrustation is prevented by rapid circulation. The boiler possesses many other commendable features. Recently one was operating the ironworks of Cobanks & Theall, and with fifty-horse power was driving all their works, and at the same time was blowing off as much steam as was used. The valuable parts of this invention can be attached to other boilers.—*N. Y. Tribune.*

Dr C. F. Chandler, of Columbia College, New York, and chemist to the Metropolitan Board of Health is in his official capacity doing good work in his repeated examinations of samples of proprietary and other illuminating oils offered for sale in the New York market, his researches being directed towards the point at which they explode. Out of one hundred samples thus far examined, not one has reached the standard fire-test, whilst some of them appear to consist mainly of benzine and naphtha. The Doctor ventilates the matter boldly in each number of the American supplement of the *Chemical News* (of which he has editorial charge) and elsewhere, and seems determined to do all in his power to suppress the sale of these dangerous liquids How worthy his object is is made apparent by the daily accounts of serious if not fatal injuries from the use of such villainous compounds. The criminal recklessness and disregard—say rather contempt—for life of many who manufacture and deal in illuminating oils is almost beyond belief, and public attention cannot be too often turned in that direction by those in authority.

Heavy Water Pipes.—The Warren Foundry, of Phillipsburg, are completing for the use of the Jersey City Water Company, eighty pipes to lay across the bed of the Hackensack River. These pipes will weigh from 6,700 to 7,000 pounds each, and are joined by a ball or universal socket five inches in thickness, the joints of which are turned perfectly true. This will enable the pipe to rise or fall in conformity with the bed of the river, without interfering with the flow of water which passes through them.

C[illegible]l Repertory.--No. 16.

OCTOBER 16, 1869.

Editorial.

ON THE NATURE AND ORIGIN OF SPECTROSCOPIC BANDS.

At the outset of my labors upon the REPERTORY, I set forth the programme that I should not hold myself confined to novel *facts* alone, but that I regarded new generalizations, and even speculations, when founded on facts and sound induction, as not less valuable in the progress of Science, and therefore not less worthy of record. There is a school of scientists, prevalent especially in our country, who affect to undervalue all hypothesis, and claim that our labors should be confined to the evolution of new facts, *ad infinitum*, piling Pelion upon Ossa, until the burden becomes too mighty for human memory. They assume that Theory will come of itself. The history of scientific progress by no means bears out this assumption. The greatest and most laborious, the most beneficent and enduring works of the human intellect have been Theories, founded upon generalizations, most frequently of facts which were discovered in great measure by others than the theorists themselves. *All such Theories were originally hypotheses*, or speculations; and he who does not speculate therefore will never discover theories, and thus neglects his duty; for though he may increase the sum of mere knowledge, he loses his chance to contribute his quota to Science, properly so called, which is made up of successful generalizations of facts and principles, that is, of Theories. Let me not be thought in this to undervalue the discovery of new facts, which of course must form an essential part of all investigation.

A memoir read by LECOQ DE BOISBAUDRAN to the French Academy, on the 16th of August of this year, however speculative some may deem it, possesses so exalted an interest in connection with those views of the nature of Light and Heat, and their relations to Matter, now becoming rife among thinking men, that I propose to try to set forth its substance. It was elicited by a previous note of MASCART, under date of August 2d; in which, after remarking that he had shown, in 1863, the six principal rays of sodium to be all double, with the two component bands in each case at the same distance from each other, he says: "This appears to be a repetition of the same phenomenon at different points of the spectral scale." Having studied, by means of photography, the parts of different spectra which lie beyond the region of the violet, he now announces that he has thus been enabled to recognize many analogous phenomena. Thus he has found that the magnesium group of three green bands coinciding with the solar ray *b* are *twice repeated* in the ultra-violet. MASCART concludes: "It seems difficult to believe that this reproduction of like phenomena can be the effect of chance; is it not more natural to admit that these groups of similar rays are *harmonics*, dependent upon the molecular constitution of luminous gases? Doubtless a great number of analogous observations would be necessary to develop the laws which rule these harmonies."

M. DE BOISBAUDRAN asserts that his own mind has been long occupied with the very problem involved in the results of MASCART; and that he has, now filed in the Secret Archives of the Academy, a sealed packet (*pli cacheté*), in which he commented as follows upon the plates representing the spectra of the alkali-metals (*cæsium*, *rubidium*, *potassium*, *lithium* and *sodium*) presented originally by KIRCHHOFF and BUNSEN: "The spectral rays of the metals of the alkalies and alkaline earths, classed according to their refrangibilities, are arranged, like their chemical properties, in the order of their atomic weights." Also that: "The spectrum of rubidium appears then analogous to that of potassium, being simply transported, as if all in one piece, towards the red"; there being, in this, as in other cases, corresponding rays in each spectrum, when the spectra are so constructed as to "space the rays proportionally to their wave-lengths."

He therefore claims to have already developed the laws which rule these harmonic repetitions of luminous rays; since upon mechanical principles, it is obvious that the heavier molecule should possess a greater wave-length than the lighter. Chemically identical luminous molecules must oscillate isochronously, because they are known to engender constant and uniform wave-lengths in the Ether. Within certain limits, increase of *vis viva* (heat-energy, etc.) increases only the amplitude of oscillation of such molecules, without affecting their isochronism. The molecule, like a pendulum, always returns towards its position of equilibrium with a velocity proportional to the magnitude of its excursions therefrom. But the force which impels the molecule towards its centre of movement is the reaction upon it of the Ether (which takes up a portion of its living force, *vis viva*, to form a ray of light) a reaction which is constant for the same velocity and mass of molecule, but varies when these vary. It follows that a heavy molecule is impelled towards its centre of equilibrium with less energy than a light one, and therefore takes more time in accomplishing one oscillation around this centre, and its wave-length is greater.

M. DE BOISBAUDRAN concludes also that in the production of light it is *the entire molecule*, however complex this may be, that vibrates as a whole; which he considers proved by the fact that when a special chemical compound is stable at sufficiently high heats, it gives out special rays differing from those of its elements. This conclusion, however, must doubtless be as yet held in abeyance, and may be found subject to qualification hereafter. The suggestiveness of future possibilities of insight, through the spectroscope, into the molecular and chemical constitution of matter, implied in these modes of viewing the subject, cannot sufficiently be admired.

He then proceeds to explain his views of the origin of the many distinct rays evolved by each elemental molecule, and which we see in the spectroscopic field. The molecule executes a system (*suite*) of distinct vibrations, constituting a sort of complex cycle, at the end of which it always returns exactly to the same initial phase. It is the vibrations of the same order, repeated in a succession of these cycles, that are isochronous, and *produce a spectral ray*. The beauty of this generalization cannot fail to strike the most matter-of-fact mind, and carry conviction of the intimate relationship that exists between Poetry and Science, in the noblest flights of these two exalted pursuits of the human intellect.

M. DE BOISBAUDRAN says further that the relations he points out have been hidden hitherto in consequence of the progression of the spectral bands, as the weights of the molecules diminish, towards the invisible part of the spectrum. A complete understanding of the manner of this progression will be a precious knowledge, as it will not only lead us to the discovery of the existence of new bodies, but will even disclose to us their chemical properties and relations. We may even anticipate the day when we shall examine into the *chemical properties of matter distant from us millions of leagues!* Light from the profundity of space shall convey to us a table of reactions of bodies which we may *never possess* on this earth!

So much for the "*pli cacheté*," deposited four years since. M. DE BOISBAUDRAN proceeds to some further developments of his views of cyclical molecular motion; stating that he has a Memoir on the subject, illustrated by numerous plates, in advanced preparation.

The simplest and most inevitable molecular motion is rotation on an axis. If such axis be relatively immovable, inequalities of the surface of the molecule would produce waves in the Ether. He supposes that thus is formed a group of rays, or elementary spectrum, *characteristic of the molecule* In case of a simple motion of rotation, there would be but one such group, having no analogue elsewhere in the spectrum. This he calls a spectrum of the *first degree*. Next, suppose the molecule to revolve around a system of two or more centres of attraction, most simply in a elliptic orbit, which he believes, for many reasons, is usually a highly *eccentric* one. Its velocities would now vary greatly in different parts of its orbit, the maximum amplitude coinciding with the perihelion passage, during which therefore the brightest rays would be emitted, but their wave-lengths would be variable, as he proceeds to show. (The concluding paragraphs of M. DE BOISBAUDRAN are by no means so clear; doubtless by reason of the lack of figures in illustration; and those who aim at a knowledge of his hypothesis in all its detail, must doubtless await the extended work he promises on the subject. I shall, however, try to present briefly and partially some of his further views.) In this orbital motion of the molecule, which presents us spectra of the *second degree*, two cases present themselves, according as (A) the rotation is in the same direction as the movement of *translation* of the undulatory cycle, or (B) in the opposite direction. That is, in the one case, the molecular day (so to speak) or the time between the striking of the heliocentric meridian, or line of force, by each of the molecular inequalities, and the birth of each ethereal wave, would be longer, than in the other. The double waves of sodium, etc., for example, would be due to such opposite motions of the molecules in a mass of its vapor. The relative positions of the inequalities of the molecules being preserved, however, the characteristic group of waves might thus be carried in a body, by virtue of increased or decreased wave-lengths and refrangibilities, towards either the red or the violet end of the spectrum. Hence repetitions of the characteristic group of bands; such repetitions being necessarily arranged according to definite laws, and having moreover relative intensities determined by inevitable laws, the group formed near the perihelion being, as before stated, the brightest. In the case (A), he shows, the repetitions would be carried towards the right or violet end of the spectroscopic field; in the case (B) towards the left or red end; of which latter case many examples, he asserts, are known.

A spectrum of the *third degree* is formed when our ellipse has itself a third motion. He supposes this to be a transverse oscillation, which would carry the spectra of the second degree, as a whole, either towards the red or the violet. The ratio of the velocities of the molecule in the first ellipse and of one point from the first to the second ellipse would determine the number of repetitions, as well as the relative distances of these partial spectra on the scale. Higher degrees of spectra than the third, he considers are not indicated by any known spectral phenomena. The third degree gives us sufficient complexity. The law which governs this mode of reproduction of the groups of rays *is that of harmonics*, for we should admit, in Optics, as in Acoustics, that we may pass to higher harmonics through increase of the motive energy imparted to the molecules.

M. DE BOISBAUDRAN promises us many new and curious developments in the way of experiments. The main use of hypothesis is to suggest new modes and subjects of experiment, and such a hypothesis as that which is outlined above cannot fail to be fertile in new experiments and discoveries. He asserts that he has arrived at the realization of the complete *synthesis* of luminous spectra.

I will conclude with two remarks; the one to recall the celebrated analogy drawn by FARADAY between the molecular constitution of matter and that of the Universe; founded on the supposition that the intermolecular spaces might bear some such relation to the molecular masses as the distances between Sun and Sun in space to the solar centres themselves; the interatomic spaces in a molecule also being compared with the interplanetary spaces. We have in this hypothesis of DE BOISBAUDRAN, this grand comparison between the Infinite and the Infinitesimal drawn still closer, for we have the molecules endowed with orbital motions simulating those of the celestial bodies, and subject therein to similar sublime and immutable laws. The grandeur of the thought is overpowering.

The other remark is to ask whether the developments of the spectroscope, especially in view of this new hypothesis of the relations of light, molecular motion and the ether, will not necessitate a complete revision, if not reconstruction, of our accepted theories of the *polarization* of light and heat.—H. W.

ORIGINAL COMMUNICATION.

Rejoinder of Prof. WALLING to Prof. VAN DER WEYDE.

PROFESSOR HENRY WURTZ:

Dear Sir: The strictures upon my paper by Dr. VAN DER WEYDE, seem to afford a characteristic example of that prevalent inaccuracy in definition, so justly deprecated in your editorial remarks prefacing the original abstract. He says, for example, that force is nothing but "matter in motion." This definition of force, which is advocated by a considerable number of modern physicists, seems to have been framed to conform to the notion that motion is transferable from body to body, or from atom to atom, and *is caused in no other way*. We may accordingly substitute "matter in motion" for force in the definition of the text books, and say that "matter in motion" is the cause of all motion or change of motion.

Were this hypothesis true, the conservation theory would not, for the maintenance of its integrity, require the interpolation of non-existent quantities like "potential energy," "latent force," etc.; for if motion were transmitted from body to body without loss or gain, the amount of motion in the Universe would evidently be unchangeable in quantity; that is, the *actual energy* of the Universe would be strictly conserved.

The inaccuracy of this definition of force, however, consists in the evident non-conformity of the consequences flowing from it to the actual facts in nature. Not one real phenomenon can be cited which, when carefully examined, will not present results which are contradictory to the hypothesis embodied in the Doctor's definition of force.

The object of my paper was to point out that neither in cosmical, in ordinary mechanical, or in atomic motions could it be maintained, that the quantity of actual motion is constant, and I do not see that the Doctor has controverted this position. If my views be sustained, it follows, either that force is alternately created and destroyed, or that it exists, in the interim of disappearance, in an independent condition. Nor will the introduction of such phrases and conceptions as "potential energy," "latent force," etc., make any essential change in the nature of the alternative to which we are reduced, at least so far as practical results are concerned. Why should *independent force* be termed a "nonentity" any more than "*potential energy*" or "*latent force*." Potential energy, as I have shown, has no *present* existence. It is admitted to be something which is to have an existence in the future.* What the Doctor means by "*latent force*" is not clearly expressed, but even if it be supposed to have a present existence, it is evidently *inoperative* in the present, and so far as practical results are concerned, does not differ from potential energy. No "matter in motion" appears to be involved in either conception. On the other hand I claim for independent force a real existence in the present.

In alluding to Professor NORTON'S question, the Doctor states that force is "*stored up*" in the pendulum when at its highest point; but how can "matter in motion" be stored up in a motionless body? An amount of force is said to be stored up in a *moving* body, the quantity being determined by the velocity of the body's motion, but it is not customary to speak of force as stored up in bodies which are at rest. Coal may be stored up in the earth or in bins, and water may be stored up in mill ponds and reservoirs, but these are not force. There exists in them only a possible development of force in the future, when the water is allowed to fall to a lower position, or when the atoms of coal are made to move into combination with atoms of oxygen.

Nor has Dr. VAN DER WEYDE answered Prof. HENRY'S question. It was not asked *how* the vibrations break the glass, but what becomes of the energy which has been expended in overcoming cohesion? Where is the equivalent "matter in motion"?

There is a curious inconsistency and injustice in intimating that I entertain the old exploded caloric or material motion of heat, which has been retained, even after scientific discovery has rendered it entirely untenable by those who seem, like the Doctor, to recognize the existence of gross matter only in the Universe. Then in the same sentence I am accused of basing the foundations of science upon "metaphysics and spiritualism," simply because I recognize the existence of something not tangible to my senses. I admit that force, or the cause of motion, is only *manifested* to the senses when motion actually occurs, but I find no difficulty, by a simple process of reasoning, in recognizing that the cause of motion may, and does exist, under circumstances such that it does not become manifest to my bodily senses, nor do I perceive that there is any "metaphysics" or "spiritualism" in such reasoning.

Some minds are so constituted that it is difficult or impossible to convince them by reasoning, of anything which their senses do not directly confirm, or which appears to conflict in any way with the evidence of their senses. An old miller of my acquaintance could not, by any amount of reasoning, be convinced that the earth rotated upon its axis. His senses had invariably taught him that a vessel containing water was emptied of its contents when inverted, and he was firmly persuaded that were the earth to turn over in the night, there would be no water in his millpond in the morning.

I will add only a single remark to my present communication, namely, that gravitation and its attendant phenomena afford the basis of the reasoning by which I arrive at the conclusion that force exists in an independent condition; and I am gratified to perceive that Dr. VAN DER WEYDE entertains views similar to those already advanced by myself, in regard to the functions of gravitation in the phenomena of the Universe.

In a future communication I will, with your permission, try to explain my notions as to how the measurement of force by its effects, as intimated in your highly suggestive remarks, point with unerring significance to its actual existence as a distinct entity, how gravitation is developed from the external "*universal forces*" which occupies all space, and how it produces all the motions of matter in the Universe.

The only assumption in regard to the Universal Force, besides its occupation of space are, that it has direction, and the property of causing matter to *move*, when the two are associated. When force and matter become dissociated, the former resuming its independent condition, matter ceases to move. This is all that it is necessary, and probably all that it is possible, for us to know in regard to the ultimate nature of force.

The only assumptions in regard to matter are, that it is made up of separate atoms, at greater or less distances from each other, and that any two atoms have the property of intercepting force from each other in opposite directions, by which means force becomes associated, impelling them towards each other. This is *gravitation*.

The assumptions that matter possesses, *per se*, any such properties as attraction, repulsion, impenetrability, elasticity, hardness, etc., etc., will be shown to be unnecessary, and to say the least, very improbable.

The conception of an independent force is gaining ground, especially in Europe. See Sir JOHN HERSCHEL'S *Familiar Lectures on Science;* subject, "Origin of Force," and articles on the subject in the *Philosophical Magazine*, by FARADAY, WATERSTON, CROLL, and others.

H. F. WALLING.

Lafayette College, Easton, Pa.

October 12, 1869.

* Apparently I have not been fortunate in making my position understood in regard to the introduction of the conception of potential energy, for the purpose of saving the conservation theory. Instead of favoring it, as the Doctor seems to suppose, I consider that Sir JOHN HERSCHEL'S objection to it is well taken. Nor do I give it any "metaphysical sense." On the contrary, I object to that *quasi potency* which has been attributed to it, and by which it is made to do duty in the present. It is obviously neither more or less than energy, which *may or will exist in the future*, and it is inaccurate and unscientific to estimate it as though it had a present existence.

American Chemical News.

CHINESE GEOLOGY AND MINERALOGY.

[Professor A. S. BICKMORE, of Madison University, read a paper to the ASSOCIATION at Salem, relating his observations during a journey of some 2000 miles in in the interior of China. From a copy of his paper, transmitted to us, we are enabled to make the following abstract.—H. W.]

It fortunately happened that the rivers, at the time, were low, as their beds in China constitute the only access in most cases to geological outcrops, there being no railroad and similar excavations there, as here. Professor B. found first a basis of granite, overlaid with grits and shales, with no fossils, as yet found. Then ancient limestones with fossils thought to be Devonian, then limestones equivalent to the Carboniferous. (A hill of limestone was visited, which was *interstratified with coal*, and burnt directly to lime by the Chinese. Fossils brought from coal rocks at Peking, are regarded by Dr. NEWBERRY as probably Triassic). Next over the limestone, a Red Sandstone.

Coal and Iron are the most important minerals observed. China, being mostly bare of forests, is dependent on coal for fuel, but this is very dear, on account of imperfect mining, and the best coal yet lies undisturbed, as for lack of pumping machinery they can mine but little below water level. Professor B. thinks the coal inferior, however, to ours. The Chinese burned coal in the time of MARCO POLO, A. D. 1290; before it was used in Europe.

There is an important mine at Mun-ti-kau, thirty-five miles southwest of the capital, which he visited. An inclined shaft has been sunk to a very great depth below the surface of the earth, following the drift of the coal, by which the coal is brought up on sleds, by manpower, one man for each sled, the capacity of which is one bushel and a half. No machinery of any kind is in use. No artificial means of ventilation are employed. By reason of the fact that the Chinese do not go below the water line, fire-damp is almost unknown.

In the north of China coal is ground to dust and mixed with clay, that it may burn more slowly.

The quantity of coal in China is immense and the supply inexhaustible.

Petroleum also was found 160 years ago in the province of Shensi. DU HALDE, in his work on China, compiled from the diaries of Jesuit priests, as long ago as 1725, says: "Its mountains distil a *bituminous liquor*, which they call '*oil of stone*,' and *use for lamps*." A kind of petroleum is also found in the Island of Formosa.

The iron yield of China is large, but the best ore comes from the beds of Sungan, in the southern part of the province of Shensi. From this the Chinese razors and other cutlery are manufactured.

Gold is found in nearly all the Chinese rivers in the mountainous districts, and the Yangste is called the "Golden Sanded River." Professor BICKMORE thinks Shensi to be the most promising gold field in the empire. It is difficult, however, to determine where gold and silver exist in China, for the law is harshly repressive of all discoveries of their deposit.

There is lead near Tungchan in Shantung, but exorbitant demands for the permission to work it, have effectually prohibited its development.

Silver and copper are found in many parts of China, the former being employed mostly in the payment of taxes to the government, and the latter in the manufacture of coin, bells, idols and articles in bronze.

There are in China extensive deposits of cinnabar, from which the Chinese manufacture mercury under the name of "water silver," but since the development of the cinnabar mines of California, the cities on the seacoast of China are supplied with quicksilver chiefly from that source.

Tin has not yet been found *in situ* in China, but the great numbers of bronze idols make it very probable that the tin used was not all imported from Malacca. If tin shall be found in China then we may expect that it will be found the chief source of the considerable quantities of that metal used in manufacturing the bronze implements that have been found in such numbers during late years, in the lakes of Switzerland.

"In review, we see that China is well supplied with coal and iron, the two minerals especially necessary for her future development, that these minerals are widely distributed over almost her whole area, and that she has thus the requisite materials for manufacturing her own cotton, without being dependent on the looms of England. Again, China possesses her share of the precious metals, and yet nearly all her ample material resources remain to be developed, though she has been the most civilized nation in all the East, and the most populous empire the world has ever seen."

PHOTOGRAPHS OF THE GREAT ECLIPSE.

[Concerning the photographs procured by our observers, on the late occasion, which were doubtless far in advance of any previously obtained, we extract the following interesting passages from the Report of Professor HENRY MORTON of Philadelphia, Editor of the *Journal of the Franklin Institute*. Professor MORTON was stationed at Mount Pleasant, Iowa; and the other stations referred to are in the same State. Professor PICKERING, of Boston, who was of the party at Mount Pleasant, has already communicated specially to us his

highly important observations, made then and thereon the question of the polarization of the light from the Corona. See our issue of Sept. 16, p. 84.—H. W.]

" * * * During the partial phases, accurately timed exposures were made by our parties, at intervals varying from a few seconds to ten minutes, and during totality 13 pictures, in all, were taken with the three instruments. Of these, six were made at Burlington, with exposures of five to seven seconds; four were made at Ottumwa, with times of exposure ranging from five seconds to sixteen. These are all admirable negatives, which show abundant detail, and in some cases much of the corona. Three pictures in totality were also made at Mount Pleasant, but for want of a clock-movement are inferior to the others. One of the Ottumwa pictures, exposed at the very last instant before totality, shows a photographic record of the curious phenomenon known as BAILLY'S beads, being simply the last glimpse of the sun's edge cut by the peaks of lunar mountains into irregular spots.

" Examination of the negatives shows us that five seconds was more than sufficient to secure all the details of the protuberances, although it gave no decided indication of the corona.

" It is a curious concidence that in this case, as well as in the pictures made by DE LA RUE in 1860, and by the German and English party last year, all the more interesting prominences are situated on the side furthest from the advancing moon, and are thus best shown in the pictures first exposed.

" The most conspicuous prominence is that which, at a hasty glance, seems to resemble the letter x, but on more careful inspection is perceived to be like an ear of corn. It consists of a solid central mass inclined at an angle of about forty-five degrees to the normal at the solar surface, and with three branches from near its upper end, one sweeping backwards in a direction generally parallel to the solar surface, another forward, as concerns the direction of the general mass, and a third branching out a little below and running in the same direction as this last. The appearance of the main body, which is of a spindle shape, and, with spiral markings, is highly suggestive of a vertical motion which has swept these whiffs of light matter into their peculiar positions.

" It appears beyond doubt, that motion amid the light surrounding the sun was observed, but this motion there is every reason to believe existed in the corona, and not in the prominences.

" Immediately to the right of this is seen a region of soft light, among which rise two similar spindle shaped masses, inclining toward the corn-ear.

" To the left appears a mass of rolling clouds, disposed in beautiful streams and curls, like the smoke from a bonfire or burning meadow, swept gently toward one side by a light wind. In connection with these are some small masses, entirely detached and floating above the general body, as was the case in DE LA RUE'S pictures.

" Other solid nodular masses appear at other points, but the next most notable prominence is one which attracted the attention of all observers, and appeared to occupy a position on the lowermost edge of the sun. It is most clearly shown in the last pictures taken at each station, and resembles in shape a great whale, with a body made up of dense cumulus cloud-matter, with a long tail clinging close to the solar edge, and stretching some forty thousand miles along. The length of the entire mass is about one hundred and ten thousand miles, and the height of its more bulky portion about twenty-eight thousand miles; while its length being about seventy thousand miles, we would have for its cubic capacity, assuming that its extent in the remaining direction is equal to its height, about 54,880,000,000,000 cubic miles.

* * * * * * * * * *

" The most distinct outbursts of the corona light are evidently associated with those prominences which are of a pointed and flame-like shape, those of a massive description, on the contrary, seeming to cast a shadow on the corona. This, we think is to be noticed in DE LA RUE'S pictures."

[Professor MORTON here relates Profeseor PICKERING'S results, which our readers already have, in our issue of September 16th, from that gentleman himself; and remarks thereupon, as follows:]

" This would certainly indicate that the light of the corona was not reflected sunlight. With a spectroscope arranged to analyze the entire light from the totality phase, Professor PICKERING also found no dark lines in the spectrum. This also points in the same direction.

" It would thus seem almost certain that *the corona is simply an electric discharge*, no doubt varying with great rapidity, as we see in the case of the aurora; and to its variations we may attribute those apparent motions of the prominences which have been observed by so many, but which our large series of photographs so conclusively shows not to have had any actual existence."

[In this connection we ought to refer our readers to the number of the *Philadelphia Photographer* for October, which is filled with most important details of the Eclipse expeditions, including some of the photographic pictures, and a later edition of Professor MORTON'S Report.]

Photographing the Patent Office Drawings.

Another important recognition of the advantages of photography over any other method for the reproduction of drawings, has recently taken place. Commissioner Fisher, of the Patent Office, has issued the following:

UNITED STATES PATENT OFFICE,
June 15th, 1869.

It is proposed, as soon as possible after the first of July, to photograph the drawings of the current issues, for the purpose of attaching one copy of the patent, of placing in the room of each examiner a copy of those belonging to his class, of binding a copy of each drawing for the inspection of the public, and for furnishing certified copies at cheaper rates than heretofore. The adoption of this plan has made it necessary to make essential modifications in the rules regulating to drawings, to which the careful attention of inventors and agents is invited. It is absolutely necessary to the success of the undertaking, that the rules should be rigidly enforced, and drawings which do not comply with them will not be received.

The rules, which are as follows, go into effect immediately:

Drawings—The applicant for a patent is required by law to furnish duplicate drawings, when the nature of the case admits of them. One must be on thick drawing-paper, sufficiently stiff to support itself in the portfolio of the office for which it is intended. It must be neatly and artistically executed, with such detached sectional views as to clearly show what the invention is, its construction, and operation. Each part must be distinguished by the same number or letter whenever it appears in the several drawings. The name of the inventor should be written at the top of the shortest side, being considered as such.

This drawing must be signed by the applicant or his attorney, and attested by two witnesses, and must be sent with the specification.

Tracings upon cloth, pasted upon thick paper, will not be admitted.

Thick drawings should never be folded for transmission, but should be rolled.

The duplicate drawing to be attached to the patent, will be furnished by the office at the expense of the applicant, and will be a photographic copy of the thick drawing. A fee of fifty cents per sheet of 10 x 15 in., will be charged, which must be transmitted with the final fee.

If the applicant does not choose to pay this fee, he must furnish the duplicate drawing, as heretofore. This must be on tracing muslin which will bear folding and transportation, and not on paper. It need not be forwarded until the patent to which it is to be attached is ordered to issue. It must have, for the purpose of attaching it, a margin of one inch on the right hand.

Copies of drawings of patents, issued after July 1st, will be furnished to any one at the uniform rate of fifty cents per sheet of standard size.

The following rules must be observed in the preparation of the drawings, in order that they may be photographed. They must be executed in deep black lines, to give distinctness to the point. In shading small lines of black, ink should be used.

Pale, ashy tints should be dispensed with. All colors except black should be avoided, even in lettering; but light blue, pink, and brown are entirely inadmissible, and deep blue, yellow, and carmine take black.

The sheet must not be larger than 10 x 15 inches, that being the size of the patent. If more illustrations are needed, several sheets must be used.

Applicants are advised to employ competent artists to make the drawings, which will be returned if not executed in strict comformity with these rules, or if injured by folding.

S. S. FISHER,
Commissioner of Patents.

This plan of photographing drawings by the Office has been contemplated for some time, both on the score of economy to the inventors and convenience to the Patent Office, but it has received a quickening impulse from recent legislation in Ohio, Indiana, Illinois, and Iowa, which requires a copy of the patent, including the drawings, to be shown in the office of the clerk of each county in which the patented article is offered for sale.

This is a step in the right direction, and shows wisdom. We have frequently had to bear with imperfect copies of drawings from the Patent Office, but trust that day is now over. Mr. Isaac Rehn, of our city, is one of the chief photographers, and Mr. Henry Howson, our talented *Bromide* counsellor, has invented a pigment of the desired color for the photographer, and to suit the draughtsman.—*Philadelphia Photographer.*

Ventilation of Mines.

It having been asserted that the sole cause of the recent frightful destruction of life at Avondale, in Pennsylvania, was the use of a furnace for ventilating the mine instead of mechanical apparatus, we give some extracts from a paper which was recently read before the Institution of Mechanical Engineers, at Newcastle, England, by Mr. William Cochrane, and published in *The Engineer*:

" It is considered a fair estimate of the economic value of the average conditions in which furnaces are worked that only one fifth of the heat due to the combustion of the coal is utilized. There are many objections, besides the small useful effect, to the use of a furnace, which cannot be overcome, and which form a constant source of cost attendant upon it, namely, the necessity of cleaning the flues and the consequent suspension of the active ventilation of the mine; the inconvenience, and in some cases the impossibility, of using a shaft highly heated, and often full of smoke, for any other purpose than as a ventilating shaft; and the serious damage done by the products of combustion to cast iron tubing, timber, pumps, or wire ropes, where winding is carried on in the upcast shaft, especially where the shaft is damp. If the conditions are unfavorable for the use of a furnace, such as shallow shafts and heavy resistances to be overcome, the furnace then is quite unable to compete with a good mechanical ventilator in economical effect. In a table compiled by Mr. J. J. Atkinson, Government Inspector for the Durham coal-field, has been showu the depth at which the furnaces are estimated to be equal to ventilating machines in point of economy of fuel, assuming that the sources of loss are of the same extent in each case, that is, the loss of fuel in furnaces by cooling in the upcast, and in ventilating machines utilized 60 per cent. of the engine power. A recent calculation by M. Guibal, of Mons, deduces the following comparisons: That if a furnace in a 12 feet shaft, 400 yards deep, circulate 53,000 cubic feet of air per minute under the total resistances represented by 3 1-3rd in. water gauge, and an average excess of upcast temperature of 108° above the downcast, with a duty of 31 lb. of coal per horse-power in the air estimated on the total resistances, then a mechanical ventilator, utilizing 60 per cent. of the power employed would, under the same conditions, have a duty of 11 lb. of coal per horse-power on the air, being a saving of 64 per cent. At a depth of 550 yards to circulate the same volume, the duty of the furnace being 22 lb. of coal, that of the mechanical ventilator would be 11 lb., being a saving of 50 per cent."

While on this subject we may also state that a machine has been invented for the purpose of proper ventilation of mines, a description of which we take from the *London Mining Journal*:

" This subject has of late occupied the attention of mining and mechanical engineers, as well as that of others who have been startled into activity by the many appalling accidents which of late have occurred in consequence of the explosive gases being allowed to accumulate in mines. The question is, no doubt, one of great importance, and they who shall succeed, either by mechanical or other contrivance, in keeping up a constant supply of good wholesome air in all parts of a mine, will have conferred an incalculable boon upon mining science. Hitherto, little provision beyond the natural condition of things, or by adding a fire in the shaft or bottom of the shaft, has been adopted; and these, no doubt, in small shafts, and in mines of very limited extent, have been sufficient in determining a current by effecting thermometrical variations. There is a degree of uncertainty about it, however, in consequence of the varying conditions of the external atmosphere, changing as it does throughout the year. Hence machines have been invented for the purpose of blowing fresh air in and of exhausting foul air out of mines, some working by means of pumps and others effecting the same object by means of centrifugal action. Mr. Lloyd, the able engineer of the Lilleshall Company, has been turning his attention to this, and he has succeeded in inventing a machine of ingenious construction, which the company has patented. The success of the plan appears to depend upon the peculiar construction and disposition of the fans, which beat the air out of the shaft, depending upon the well-known elasticity of the atmosphere to supply its place.

This he does by means of a centrifugal fan, driven by an engine. The one we saw was a beautifully-executed model, with fan 18 inches in diameter and 6 in. wide over the blades, which, measured by the areometer, produced exhaustion at the rate of 2500 feet per minute, with a water guage of one-quarter inch. But the company are erecting a larger one, to be worked by a small horizontal, direct-action engine, which shall be described when in operation. It may be stated that the success which has hitherto attended the trials made surpasses all expectation, and the effects produced appear incredible. He first made a 2 feet 3 inch fan, which exhausted 2,500 feet of air per minute; and an-

other, with a 5 feet fan, 1 foot 10 inches broad, which exhausted 25,196 cubic feet per minute, with a water guage of 2¼ inches. Indeed, the effects were such as to be incredible to the inventor until after repeated measurements, in the course of which several areometers were torn to peices by the force of the current of air created.

The Croton Supply.

The idea that the supply of the croton water may possibly become exhausted is to most people as novel as it is alarming. That supply has seemed so ample, so equal to any probable emergencies of waste, or drought, or swelling population, that the Croton has been popularly regarded as being almost like the ocean in its ability to yield the more, in the ratio of the demands upon it.

Yet the lengthened drought that has caused so much trouble elsewhere, finally brought the flow of water in the reservoirs to such limited amount, that stringent measures had to be adopted to economise its use until relief should come from copious rains.

New Yorkers have especial reason to be greatful for the storm which prevailed on Sunday and up to noon of Monday, because it is bound to bring us an increase of our hitherto rapidly decreasing supply of Croton, and renders the threatened drought a matter of impossibility. On the first of September, the depth of water in the Central Park reservoir, was 55 feet 9 inches By the 27th, this supply had decreased 6 feet 3 inches; but the energetic measures taken to stop the waste and compel economy in the use of water, caused a gain of about 2 feet in four days. On october 1st, the decrease had been reduced to 4 feet 3½ inches. The lowest point reached by the water in the reservoir, during the dry spell, was 11 feet 6 inches. On the 24th of September the supply was 6 feet 5½ inches below the top of the dam; but between that and the 2d of October, there was a gain of 2 feet 1¼ inches; at the latter date, the space from the top of the dam to the surface of the water being 4 feet 3 inches. The rainfall ending at noon Monday, was 4.21-100 inches, and its effect, now that the fall has percolated through the earth and found its way into the Croton River, is to be seen in an over-flowing reservoir. The ground was in an excellent condition to allow the rain to tell upon the water supply, as the storm which preceded this one had dampened the earth to a degree suffic ent to prevent its absorbing the water to any very great extent, as would otherwise have been the case. The amount of fall in and around the section of Putnam County, known as the Croton water shed, must have been very great, and it is a consolation to know that it has been sufficient to avert the state of affairs which, to say the least, was threatening to put our people to a most serious inconvenience. It is safe to say that the crisis is passed, so far as concerned a lack of water, which began to alarm our citizens; and, by the exercise of even a moderate degree of care to prevent waste, no inconvenience will be suffered by the Metroplis.

The action of the Fire Commissioner in placing steamers at four points of the city to supply the street water carts, was an effort duly appreciated by the merchants whose goods were being ruined by clouds of dust, as well as by everybody whose business or pleasure called them to brave the incense offered from the neglect of the contractors to properly clean the streets. True the means were scarcely equal to the extent of the occasion, but the act was most commendable and deserving of a most extended recognition.

Meanwhile, as people will consider, under the sharp pressure of necessity, what without it is neglected, the time is a good one to devise means of relief from future trouble. It is clear that New York wants more water. No supply can be reckoned adequate for a great city that six week's drought can exhaust. The population has out turned the Croton, and the existing system must be largely reinforced. There are three ways in which this may be done. First, by bringing more water from a distance; second, by using that of the Hudson; and third, by sinking Artesian Wells. The first plan is attended by serious engineering difficulties, and would cost an enormous sum of money; the second is apparantly impracticable, because of the saltness of the water; and the third is unfortunately liable to geological ocjections. The formation of Manhatan Island is very unfavorable for Artesian Wells, for domestic use, for the reason that the strata are nearly vertical, and cut off from higher districts by deep salt water channels, so that the water obtained in most portions of the city although abundant, is impregnated with salt to a greater or less degree. This, however, does not impare its usefulness for extinguishing fires, and as an abundance of water for this purpose is indispensible, and can be thus obtained at a very moderate expense, no time should be lost in securing it by driving tubes as illustrated in our columns last week. The pipes can doubtles be found already made, and would need only to be provided with a solid point and a strainer upon the end to fit them for being forced to a sufficient depth to secure an inexhaustible supply at any point desired.

Yet, whatever the objections to such wells, it seems likely that we shall be driven to their use; since those objections, grave as they may be, are probably surmountable, while to the adoption of the other two schemes the barriers are declared to be otherwise. Unless the river can be freed of salt—and this on a large scale, and at suitable cost, is said to be out of the question—it is obviously useless as a beverage, although it can be availed of on a pinch, as now, for other purposes. An additional river or lake supply from a distance is affirmed to be helpless. Under these circumstances, we shall probably be driven to Artesian wells. But these need not, of necessity, be sunk on Manhattan Island. Appropriate spots may be selected upon the main land north of the city, or even upon Long Island since the bridge or bridges over the Eeat River will soon afford ready means of conduit. Ultimately, perhaps, there may be several systems of Artesian wells, and there will certainly be no insuperable abstacles to bringing the water so obtained into the heart of the city.—*Fireman's Journal.*

The Use of Lead Water Pipes.

While the evils attending the use of lead pipes for water are doubtless greatly exaggerated in the articles written upon this subject in the newspapers, no candid investigator has, to our knowledge, denied the existence of such evils, or attempted to prove that such pipes are not objectionable in a sanitary point of view.

Though the use of these pipes is very extended, and startling cases of lead poisoning are not common, it must be remembered that lead is one of the most insidious of poisons, accumulating little by little in the system through long periods of time. The results, when produced, may not even in many cases be traced to the action of lead, and there is reason to believe that in certain ailments this cause is often overlooked. There is always a contingency that among a large number who use water contaminated slightly with lead, some one more susceptible than the rest will be injured.

In a recent paper read before the Scientific Club, at Waterbury, Conn., by Dr. C. S. Redman, the following symptoms of lead poisoning were enumerated, some or all of which may be considered as the forerunners of serious disease:

1. A blue discoloration of the gums at their junction with the teeth. This was observed about the same time by Tanquerel, by Dr. Schilbach of Neustadt, and by Dr. Brinton of London. The discovery of this mark has proved a blessing to thousands. When present it is positive evidence of the poison; it is not, however, developed in every case. M. Brachet (Paris, 1850), states that it is almost always present in patients poisoned by inhalation.

2. A metallic taste and foetid breath. Observed also in slow poisoning from other metals, as mercury and copper.

3. Lead jaundice. Sometimes the complexion assumes an earthen hue; sometimes it becomes transparent and waxy, presenting an appearance of excessive delicacy.

Emaciation is an occasional phenomenon. These primary effects rarely coexist.

The diseases likely to follow are:

1. Colic, or neuralgia, chiefly abdominal. It is common, and well known as lead or painter's colic

2. "Arthralgia," or neuralgia of the limbs. These are anomalous pains, chiefly in the limbs, and without redness or swelling. The cause being overlooked, rheumatism is generally assigned as the explanation. In true rheumatism the joints are most involved. In ordinary neuralgia, the pain chiefly follows the nerve trunks. In this affection the pain is in the finer branches of nerves distributed to the muscles.

3. Paralyeis, or lead-palsy. Any muscles of the body may be involved. The arms, wrists, and fingers are oftenest weakened. Paralysis is usually only partial. Wristdrop is characteristic. Amaurosis, or paralysis of the retina; deafness and loss of voice are occasionen.

4. Cerebral affections. The most frequent of these are convulsions; they are usually epileptic.

In view of these facts there cannot be two opinions as to the impropriety of using lead pipes for water when their use can be avoided, and pipes are now manufactured and sold, which insulate the lead from the water by a lining of block tin, a harmless material, durable, and not very expensive.—*Sci. American, Oct.* 2.

Joseph Whitworth, the inventor of the Whitworth gun, and William Fairbairn, the celebrated engineer, have been created baronets.

Correspondence.

[Correspondents in all cases should sign their communications with their names and address in full, not necessarily for publication, but as a guarantee of good faith.—Eds.]

Setting of Retorts—Prospectus of a Work on the Subject.

New Albany, Ind., Oct. 8th, 1869.

Messrs Editors: In looking over communications received by me, many questions are asked in regard to the best method of setting retorts; but how to erect a bench of retorts, that may be worked up to a capacity of 7,000 feet of gas per retort in 24 hours, that is the question. Now this could not be answered in two or three letters, and do the same justice. It is a well known fact to all that every department in the conveying of gas from retort to holder, has received special attention. Patented improvements are many, and a strain upon retorts is a thing of the past; yet from the many letters received, and from special observations, I am satisfied there are but few who make 5,500 feet per retort in 24 hours; and many, very many, fail to make 3,000 per retort. Feeling qualified to advance some original ideas, and being frequently requested to give that experience which I have found the most acceptible.

I propose to write a book, 18 mo, which will contain plans, with specific instructions, how to erect a bench of retorts that may be worked up to a capacity of 7,000 per retort in 24 hours; also containing that advice which will enable the profession to manage and work the same six months without intermission, making on an average, if desired, 6,500 feet of gas per retort, in 24 hours with ease, on a yield of 4¼ feet to the pound of Pittsburgh coal.

Also containing that information which will enable all to limit the growth of carbon, from ¼ inch to ⅝ inch during the above period of six months, with instruction how to let heat down, repair furnaces, and start the same for another six months trip, and obtain like results for six or twelve months more. Also containing instructions how each works may burn their own lime, reducing cost of same from 40 to 100 per cent. If with this assurance to the profesfion, I receive 100 subscribers, at five dollars each, I will, without delay, publish and distribute the same, feeling that I can make the work to their interest, and honorable to myself.

I remain, gentlemen, Respectfully,

John Dunbar,

Suprintendent Gas Works, New Albany Ind.

P. S. The profession desiring a copy of "Dunbars Practical Gas Retort Setters Guide," are respectfully solicited to forward their names for insertion in this Journal.

An Improved Device for "Kyanizing" Wood.—The San Francisco *Mining and Scientific Press* describes a new apparatus for this purpose, lately invented by Mr D. W. Hunt, of San Francisco. It consists in a cheap device for forcing the solution into the pores of the wood. Instead of placing a stick of timber in a boiler or expensive cylinder, as has hitherto been necessary, the inventor simply places a plate upon one end of a stick of timber, so constructed, by having its edges turned up, as to make a water-tight joint by being pressed against the end of the timber, and at the same time leave a small chamber between the face of the plate and the end of the stick. Into this chamber is forced, by hydraulic pressure, the preserving fluid, be it oil, liquid sulphates, creosote, or any other kind of liquid. The pressure forces the liquid into and along the pores of the wood, driving the sap before it as far as is desired—through the entire stick and out at the top, or only for a short distance, as for the bottom of fenceposts or the ends of timber designed to be placed in brick walls, where, without some such preserving process, they soon decay, by means of the moisture abstracted from the bricks. It is claimed that a large number of these machines may be constructed at small cost, and by means of a small force-pump may be operated in the field or shop, or wherever else it may be convenient to effect the preservative process. The plate is held in place by connecting-rods passing through a similar plate fixed upon the opposite end of the timber.

The Sun and Earth—Curious Influence—A Magnetic Storm.

On September 1, 1859, shortly before noon, two astronomers—Messrs. Hodgson and Carrington—one at Oxford, the other in London, were at the same instant scrutinizing a large group of sun spots. On a sudden, two intensly bright patches of lights appeared in front of the cluster. So brilliant were they that the observers thought that the darkening screens attached to their telescopes must have become fractured. But this was found not to be the case. The bright spots indicated some process going on upon the sun's surface—a process of such activity that within five minutes the spots travelled over a space of nearly thirty-four thousand miles.

Now, at the Kew Observatory there are self-registering magnetic instruments which indicate the processes of change by which the subtle influences of terrestrial magnetism wax and wane. At one time the line traced by the pointer will be marked by scarcely perceptible undulations, indicating the almost quiescent state of the great terrestrial magnet. At another, well marked waves along the line exhibit the pulsations of the magnetic system, influenced in a manner as yet unintelligible to the physicist. And then there is a third form of deiturbance—the sharp, sudden jerks of the pointer exhibiting the occurrence of those mysterious phenomena termed "magnetic storms." When the records of the Kew Observatory came to be looked over, it was found that at the very instant in which the brilliant spots of light had appeared to Messrs. Hodgson and Carrington, the self-registering instrument had been subjected to the third and most significant form of disturbance—a magnetic storm began, in fact, as the light broke out on the sun's surface. But this was not the only evidence of the sympathy with which the earth responded to the solar action. It was subsequently found that soon after the spots of lights had appeared the whole frame of earth had thrilled under a mysterious magnetic influence.

At the West Indies, in South America, in Australia, wherever magnetic observations are systematically made, the observers had the same story to tell. In the telegraph stations at Washington and Philadelphia, the signalmen received strong electric shocks. In Norway, telegraphic machinery was set on fire. The pen of Bain's telegraph was followed by a flame. And wherever telegraphic wires were in action, well-marked indication of disturbance presented themselves. Even this, however, was not all. The great magnetic storm was not a mere instantaneous electric throe. Hours passed before the disturbed earth resumed its ordinary state. And thus it happened that in nearly all parts of the earth night fell while the storm was yet in progress.

During the night magnificent auroras spread their wavering streamers over the sky, both in the Northern and Southern hemisphere. As the disturbed needle vibrated, the colored streamers waving responsive, and it was only when the magnetic storm was subsiding that the auroral lights faded from the heavens. Now it is evident that these phenomena show the most intimate relation between these peculiar disturbances in the sun and the magnetic currents of our own earth. Directly one of these changes take place upwards of 90,000,000 of miles away, the electric condition of our planet is changed in some mysterious way, of which our instruments, and even the condition of our sky bear record. The pens of all our telegraphic wires may some day trace in flame a handwriting more ominous of human destiny, than was the handwriting which during Belshazzar's feast traced a warning on the wall of the fall of the Babylonian dynasty. Moreover, note this, that these changes in the condition of the sun take place at intervals of about 11 years.

The variable stars which swings round it, as well as supplying us with light and heat, and (apparently) magnetism, clouds over every 11 years these spots, so that it seems most likely that every 11 years certain magnetic conditions recur which have not occurred in the interval. If so, perhaps the magnetic excitement of 1859 will recur, and it may be in much greater force next year—in 1870; and if it does, how are we to say what may or may not occur with it?

Even now one such epoch of magnetic storm seems to be thought pretty near at hand. The sun has been lately exhibiting the most surprising forms of disturbance, and presenting to scientific eyes less "fixity" of essence than ever. Spots so vast that we must estimate their dimensions by millions of square miles have broken out from time to time, and have presented rapid changes of figure, indicating the action of forces of inconceivable intensity. Clusters of smaller spots extending over yet vaster areas, have exhibited every form of disturbance known to the solar physicist, and every degree of light, from the apparent blackness (in reality only relative) of the nuclei, to the intense brilliancy of the faculous ridges. And we now know that these appearances are not merely matters for the curious, with which, as they happen at a distance of above 90,000,000 of miles, practical men need not concern themselves.—*London Spectator.*

Green and Dry Wood for Fuel.

Few are aware of the great loss of heat sustained in the use of green wood for fuel. Green good wood will lose, in being properly seasoned, about one third its weight in water; or fully 150 gallons of water. Now all the water in every particle of wood must be evaporated before it will burn, and to evaporate that water, wood must be used which has already parted with its water. Hence in burning a cord of green wood we must substract from its total heating power enough to evaporate 150 gallons—nearly four barrels—of water. The amount is absolutely thrown away, so far as any practical use can be made of the heat evolved by it. The evaporation of 150 gallons of water is equivalent to rising 750 gallons to the boiling point.

The heat, however, so employed, is more econonically used than it could be in any of the contrivances for evaporating or boiling water, so that for this and other reasons, which might be named, the real loss of heat in burning green wood is liable to be overrated; yet careful estimates and actual experience show that seven cords of well seasoned wood will go as far and throw as much heat, for practical purposes, as eight cords of green. Of course, this estimate applies only to the extremes of green and dry; as the actual results will vary exceedingly with wood of different degrees of seasoning and different varieties of growth. The more porous the wood, the greater the necessity for thorough seasoning.

Seasoned wood will sometimes burn with such great rapidity that the heat which it gives out cannot be readily controled, and much of it is necessarily wasted. Under such circumstances green wood or a mixture of green and dry may be advantageously employed. Where the draught can be properly regulated, however, as in an air-tight stove, seasoned wood should always be prefered for either convenience, comfort, or economy. Moreover, when wood is drawn from a distance, it is well to consider that with every cord of green wood half a ton of water must also be hauled.—*Mining & Scientific Press.*

MISCELLANEA.

Professor Seely succeeds the Rev. Charles Kingsley as Professor of Modern History in Cambridge University.

What Would Occur if the Earth Should be Stopped in its Orbit.—If the earth should be stopped in its orbit, it would begin to fall straight towards the sun. As it approached more nearly to that great source of heat it would soon reach a point where the temperature is as high as 212°, and then all the waters of the ocean would be evaporated. As it drew still nearer, the rocks would be melted, and afterwards they also would be evaporated. Before it reached the sun this solid earth would be converted into a vast volume of red-hot gas, which, when it fell into the fiery atmosphere of the sun, would merely produce blasts of wind at the point where it struck outward in all directions.

Interesting to Petroleum Dealers.—A French savant, Professor Deville, has lately submitted to the Academy of Sciences in Paris, an essay on the cause of petroleum explosions and consequent conflagrations. He finds the cause, not in the greater inflammability of the oil, but in its great expansion of volume under the influence of a higher temperature. Barrels filled with the oil in the winter season either burst or crack that the oil may flow out as soon as warm weather sets in. The oil thus freed evaporates a highly inflammable gas, which takes fire at the touch of the smallest spark. He therefore advises that oil should be shipped or stored in casks but partially filled, giving it room to expand in the higher temperature of the warmer seasons.

The Great Waste of Gas.—In both London and New York complaints regarding the quality of gas furnished to consumers has led to a recent examination of the subject, and the appointment of referees for its settlement. The report of these referees shows, among other things, that the light given by gas depends in a great measure upon the shape of the burner. Those of the "fish-tail" sort are wasteful. Yet with cannel gas they give better results than the argands. The kind of gas should therefore be considered; and the form of burner adapted thereto. One kind of bat's wing burner gives an illuminating power of 99, while the best fish-tail with the same gas gives only 89. The result is an enormous waste of gas—because this description of burner is most commonly in use.

The portraits which have recently appeared in *Appleton's Journal* and attracted so much attention on account of the exquisite manner in which they are engraved, are the work of Mr. Edward Sears, the engraver, of Beekman street, in this city. This artist is one of the ablest in the United States, and in some respects, probably, has no equal. The portraits in question are remarkable for the perfection with which they delineate the features and the expression of the countenance The same artist engraves frequently for Harper & Brothers and other publishers, and all his work is marked by the same general excellence. There is nothing more important in our book literature than the illustrations. A few years ago we were wofully deficient in engravers; now American book engravings will compare favorably with anything done on the Continent of Europe.

Velocity of the Electric Impulse,—The discordant results that have been arrived at by experimenters upon this subject, have been due to imperfect apparatus. Give the current a conductor that offers no resistance, or put on battery power enough to overcome the resistance, and electricity will probably be found able to hold its own with light. As an evidence that an increase of battery force increases the speed, may be instanced an experiment lately made by Prof. Hough, of Dudley Observatory. Over a circuit of 1,000 mile, of wire, with 75 cups of battery upon one end and 45 cups on the other, he obtained a speed of 12,200 miles a second. By increasing the battery to 90 cups at one end and 75 cups at the other, increased the velocity to 14,400 miles a second.

A Remarkable Combination of physical forces applied to purposes of war has lately been made the subject of experiment at Antwerp with a view to the defense of the passes of the Scheldt. Torpedoes are placed in the river, and cameras similar to those used by photographers are adjusted, so that an object directly over one of them will present its image in the instrument situated upon the shore at any convenient distance. As soon as the image of an approaching hostile vessel appears in the camera, an electric current is sent through a wire to the torpedo which underlies it, and the explosion takes place.

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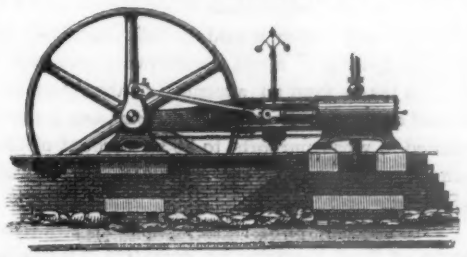

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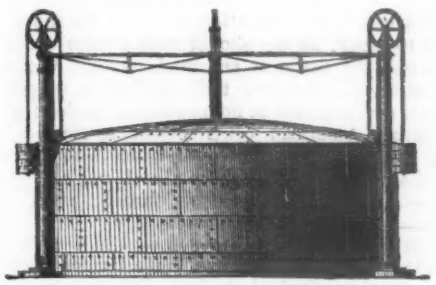

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PROFESSOR HENRY WURTZ.

☞ [NOTE BY PROFESSOR WURTZ.—Contributions and items for which I am, as a Scientist, individually responsible, will have attached my full name or initials.—H. W.]

SATURDAY, OCTOBER 16, 1869.

WISHING TO MAKE this Journal an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of those subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS* or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

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SCIENTIFIC INTELLIGENCE FOR THE AMERICAN MARKET—(SUPPLEMENTARY. NOT COMPLIMENTARY.)

The present writer would be fully justifiable in "cutting up rough" about the following paragraph; which is taken from an appendix to the American Reprint of the London *Chemical News*, being there included in what purports to be an account of the chemical papers read to the AMERICAN ASSOCIATION at Salem:

"Professor H. WURTZ read a paper on the Grahamite of West Virginia; he considers it inspissasated petroleum, and not to be classed with coal, Albertite, or asphaltum. It is almost wholly dissolved by bisulphide of carbon and by chloroform, forming a dark brown liquid. This contains two substances, *viscosine* and *iriscine*, which are separated by means of sulphuric acid. *Viscosine* is a viscous hydrocarbon, insoluble in most menstrua. When a solution of *iriscine* is allowed to evaporate in a thin layer, a beautiful iridescence is developed, which appears to be a characteristic reaction, and suggested the name of *iriscine*. Grahamite has been recently discovered in Colorado, resembling the Virginia mineral in every respect."

Our own readers, having had the complete paper in our last issue, are in condition to be simply amused, and not misled, by this "Comedy of Errors." I am reminded of the saying (somewhat coarse I confess), that if you "give a lie ten days start, the truth will never catch it"; but still there is nothing to be done in such cases, but to tell the truth over again, and to request our *confrere* to present our own side of the story. To wit: The said paper of HENRY WURTZ, on Grahamite, was most expressly calculated to disprove the tradition that grahamite is "inspissated petroleum." Whether successful or not in this, remains to be seen.

The name "iriscine" was never "suggested" to the author of the said paper, but is a figment of the imagination of our contemporary.

Instead of separating irisine from viscosine, sulphuric acid profoundly alters the nature of the former substance, making it insoluble in all menstrua. Viscosine is easily *soluble* "in most menstrua," including ether, petroleum, etc., etc.

The Colorado grahamite was *discovered* in New York and not in Colorado. It does not "resemble the Virginia mineral in every respect"; the differences in aspect at least being so marked that the identity could only have been recognized by chemical analysis, as it was. In fact, the external resemblances of the Colorado resinoid are such that it passed universally for *albertite*, until the present writer discovered (in New York) its identity with grahamite.

We trust our respected contemporary will not find in us, in calling attention to this matter, a lack of courtesy; the accusation of which we should regret to incur; as we should rather take credit in this case for patience and moderation. We must be allowed, however, the concluding suggestion that if our Journals at home succeed so dolefully in reporting American contributions to Science, we can scarce retain the "countenance" to complain of the notorious blundering and neglect which American Science experiences abroad. H. W.

* It will not be *malapropos* to allude here to a case that has just met my eye, in the London edition of this same periodical, of the lack of that accuracy and exactness whose absence confers a value on scientific reports to be designated only by a *minus* sign. In a mention of the recent investigations of Professors B. SILLIMAN and H. WURTZ, on the Effects of Admixture of Air with Illuminating Gas, which our readers have had in full, these are attributed to "B. SILLIMAN and A. WURTZ." This little circumstance, in other aspects trfling, is considered worthy of note just now by the present writer for several reasons; one being that it is by no means the first time it has happened; another that the great French chemist, for whom I have here the honor to be mistaken, is in no need of such morsels of fortuitous fame, especially at the expense of another, and would doubtless "scorn the haction;" another that it may amuse our readers to see whether the *American* Reprint will follow strictly this particular idiosyncracy of its original.—H. W.

THE NEW METHOD OF MAKING GAS.

The Gwynne-Harris or Hydro-Carbon process, or improvement in making gas, to which we have frequently alluded in this Journal, has, as we predicted, achieved a remarkable practical success in the past year, and is fast becoming popular with gas men throughout the country. In fact, no intelligent gas engineer or expert can longer doubt the array of facts, substantiating all, and more than the inventors have claimed for it; made positive by the practical working of the process for many months, and also by the very lengthy, elaborate, and critical scientific examinations and series of tests to which it was subjected by Professors B. SILLIMAN and HENRY WURTZ, a report of which has been published by the National Coal Gas Company, No. 7, Beekman street, New York.

This process has been worked very successfully for many months, at Fair Haven Gas Works Conn. It is also in operation at New Haven. Mr. H. Fish, President of the Utica Gas Works, New York, has lately introduced this process with very satisfactory results, we understand. It is also being introduced in the Westchester County Gas Works, and the Newark, New Jersey, Gas Light Company, have lately purchased the right to use it, and are putting it in their works. At Elizabeth, New Jersey, where it has been more or less in use for over three years, they are building a new Retort house, and fitting the entire works for this process. It is also being introduced elsewhere, and several of the largest Gas Light Companies through the United States are negotiating to purchase the right to use, and will doubtless soon have it in operation.

In an exchange an article has appeared, written by Mr. A. L. ALLEN, of Poughkeepsie, New York, a gentleman who is familiar with the matter, and who has purchased the right for the State of New York, which so concisely states the facts in the case, that we shall venture to refer to it in this connection. He says:

"The *Gwynne Harris Hydro-Carbon* process for the manufacture of gas, is now attracting great attention, not by making a few laboratory tests and then puffing it before the public, but by its practical results.

"It was tested for many months in the old works of the Elizabeth, N. J., Gas Light Co., who then purchased the right for that city, and are now fitting up their new works for its full introduction. About one year ago, the New Haven Gas Light Company, entered into a contract with the National Coal Gas Company, of New York, to the effect that the New Haven Company would furnish its small Works at Fair Haven Conn., and the coal, for the purpose of having the merits of this process fully tested to their satisfaction. They were to have the control of the Gasometers and Photometer, and the whole was to be under the supervision of Prof Silliman, one of the Incorporators and Directors of their company. When they became fully satisfied that it was a positive and important improvement upon the old method, they were to purchase the Right for New Haven and Fair Haven, at a stipulated price. The Fair Haven Works had stood idle for five years, and were in poor condition. Only one bench could be run at a time, as a general thing, it was therefore very difficult and almost impossible to keep up a steady heat. Yet under these, and other disadvantages, the National Co., undertook to compete with the New Haven Co., (whose Works are known to be among the very best in this country, and run by Mr. Cox, a most competent and reliable Suprintendent) for the superiority of the Hydro Carbon process over the old method in the *yield, purity, density, permanency*, and *illuminating power* of the gas produced from the *same coals* and at the *same cost*.

"After the severest tests from Dec. 1, 1868, to March 1, 1869, Prof. Silliman reported to his company in favor of the Hydro-Carbon process in every particular, and stated that they could safely count upon a net profit of at least thirty three per cent. over the old method.

"The President of the New Haven Company, still fearing that this process might require some peculiar manipulations, which Mr. Harris (one of the inventors, and the engineer of the National Co., who suprintended these experiments) alone understood, requested that, before closing the contract, their superintendent, Mr. Cox, might have control of the Fair Haven Works for one week. This was readily granted, and Mr. Cox took charge thereof on the first day of March last.

"After running the same for three weeks he reported to his company that the Hydro Carbon process required no peculiar manipulation or ingenuity on the part of the superintendent or workmen, and that it would be worth $2,000 per year to them, merely on account of the absence of *ammonia* from the gas, and that it would be worth to them many thousand dollars on account of its superior density and permanency.

"Of course the New Haven Co. immediately closed the

purchase, and it now is in operation there. Other companies are following their example. And why not? The report of Professors Silliman and Wurtz, published by the National Coal Gas Co., shows that the practical workings of this process exceed Bunsens laboratory tests, and come nearer to the theoretical requirements of chemistry than was ever reached before. They show that the gas requires no "scrubbing," that it is more free from the common impurities, and has greater density and permanency, and higher illuminating power than gas made in the old way. This has been shown by practical experiments on a larger scale than has ever been attempted by any other competing process.

"Common illuminating gas will depreciate five per cent in twenty-four hours. Professor Silliman shut up the Fair Haven Gas holder for three weeks, from the 28th of December, with 25,000 feet of gas, and it depreciated only 1,5-100 per cent.

"He made three tests each by freezing to 6 degrees below zero, of the gas of the Fair Haven, New Haven and Manhattan works. The Fair Haven gas depreciated only 8 per cent., while the New Haven and Manhattan gas lost 29 per cent during that time. If any one doubts this the test can be repeated if the Manhattan or any other gas company will consent. The Fair Haven works are open for inspection, and investigation is courted by the National coal gas company, whose office is at No. 7 Beekman street, New York.

"With one bench of threes, from December to May, and with two benches of threes from that time to the first of September inst., there was carbonized at Fair Haven by the Hydro Carbon process 827,950 pounds of coal, which produced 5,315,500 cubic feet of gas, being an average yield of 6,42-100 cubic feet per pound of coal, of 16,90-100 candle power.

"Mr. Cox's report for August (being the ninth month of practical workings) shows, that with two benches of threes he carbonized by this process 116,400 pounds of coal, which produced 741,100 cubic feet of gas, of 18,-21-100 candle power, being an average of 6,38-100 feet per pound of coal.

"The highest average yield of gas, by the old method is four feet per pound of coal, of about 13 candles. Reduce the Hydro Carbon gas from 18,21-100 to 13 candles and it will add more than one third to the above yield of 6,28 10-0 feet per pound.

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PAPERS, ETC., RECEIVED.

The following papers and pamphlets have been received, but owing to the crowded state of our columns we omitted to notice them:

"THE POLYTECHNIC."—A semi-monthly publication of eight pages, devoted to the interests of Polytechnic and Scientific Schools, and a record and review of civil, mechanical and mining engineering, and general College news. It is very neatly got up, and is printed on tinted paper. Edited and published by MONTAGUE L. MARKS, 208 and 210 River street, Troy, New York. Subscription, $4 per annum.

"THE AMERICAN GROCER."—A semi-monthly journal of 20 pages. It is an invaluable text book for the grocer, or any one who feels an interest to know the properties of many of the life-sustaining articles. Published by JOHN DARBY & Co., 161 William street, New York. Subscription, $2 per annum.

"TERMS FOR SUPPLYING GAS TO CONSUMERS BY THE LOUISVILLE GAS CO."—This pamphlet contains much that is of interest to gas consumers of Louisville, and none should be without a copy.

"THE PROGRESS AND CONDITION OF SEVERAL DEPARTMENTS OF INDUSTRIAL CHEMISTRY."—A pamphlet of 146 pages, and seven illustrations, by J. LAWRENCE SMITH, U. S. Commissioner to the Paris Exposition. Its contents treats on the following subjects: Manufacture of Sulphuric Acid, Soda and Salts of Soda, Potash and its Compounds, Ammonia, Baryta, Magnesia, Alumina, Chlorine, Fluorine, Manganese, Carbonic Acid, Industrial Production of Oxygen, Hydrogen and other elements, manufacture of Illuminating Gas from Coal, the Utilization of Waste Products, etc. We shall make such extracts from it as will prove interesting to our readers.

TO THE GAS PROFESSION.—Attention is called to the advertisment headed "Dunbar's Gas Retort Setters Guide," wherein the advertiser proposes to publish a work under that title, which will prove of great value to those immediately interested.

As the subscribers are limited to 100, those desirous of having the Work, should not delay in sending in their names to this office. The subscription price is fixed at $5.

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With specific instructions how to successively manage the same, so as to obtain like results for six and twelve months more, thereby creating a great saving in capital and labor. Also, instructions how to burn your own Lime in a vacant oven.

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[Extract from testimony from Suprintendent Chelsea Gas Co., Mass.]

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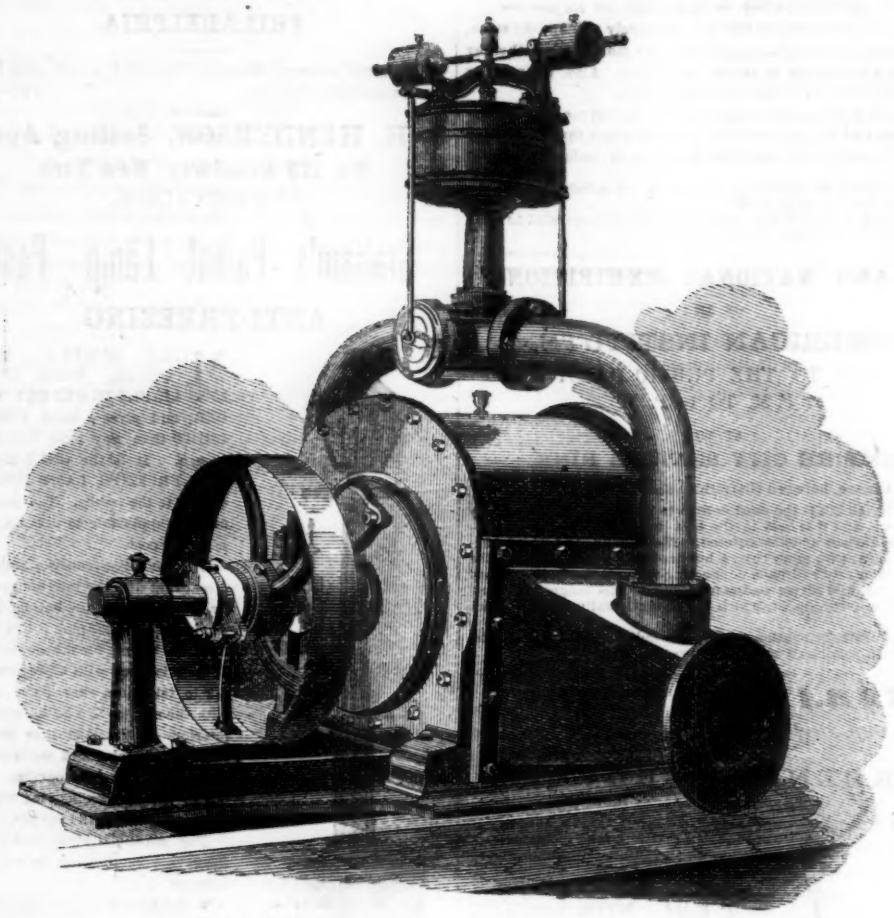

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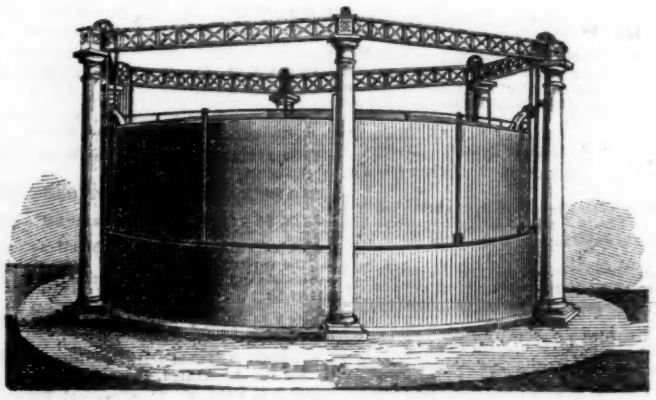

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Fig. 2 represents wedge and one-half of gate.

Fig. 3, a section through body, gate and wedge, intended for larger sizes of water valves required to bear heavy pressure either side.

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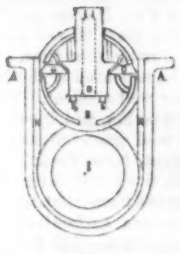

FIG. 3. FIG. 2.

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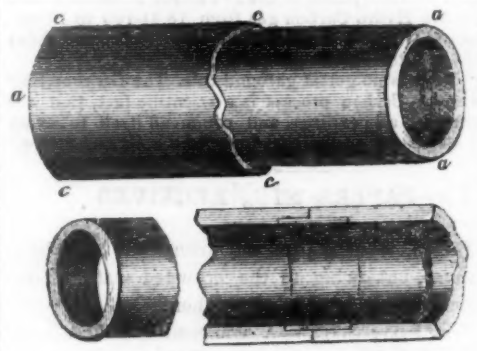

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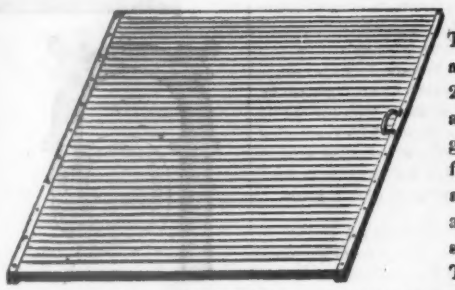

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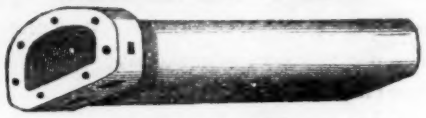

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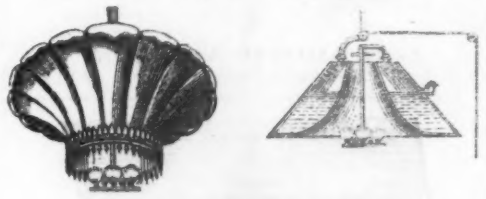

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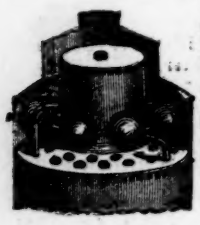

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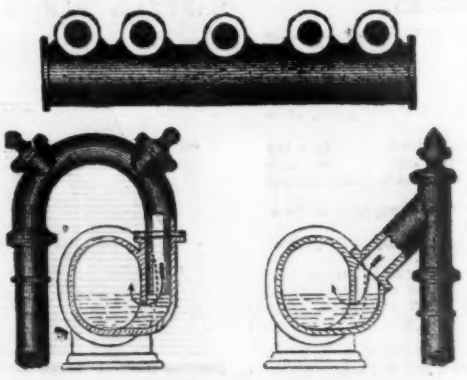

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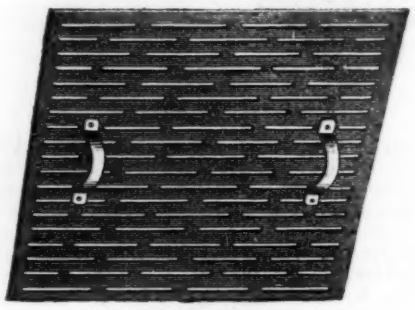

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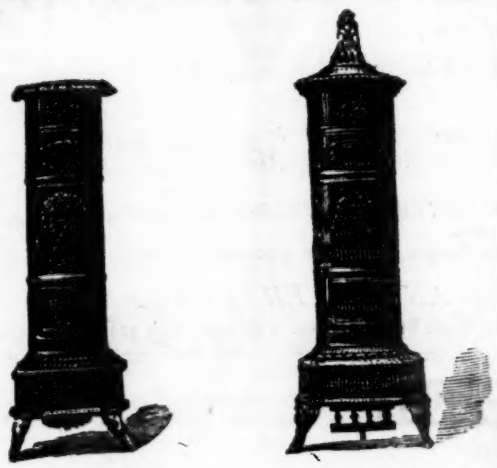

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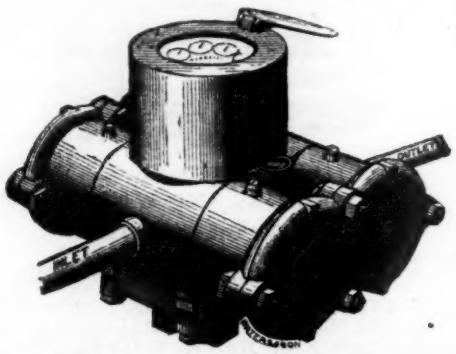

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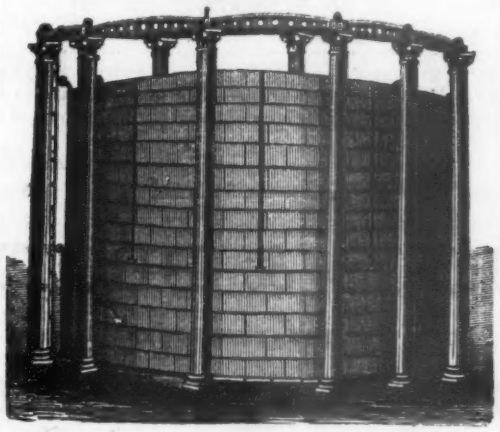

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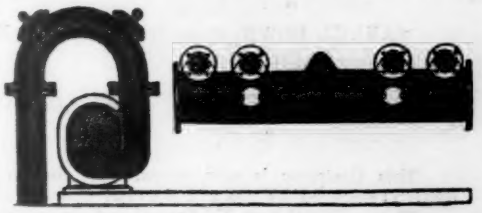

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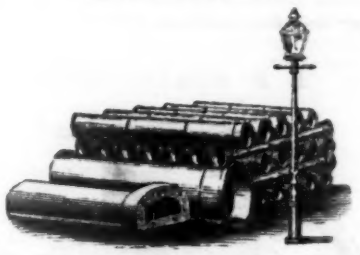

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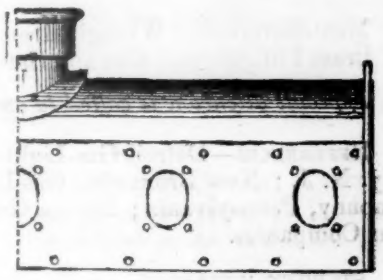

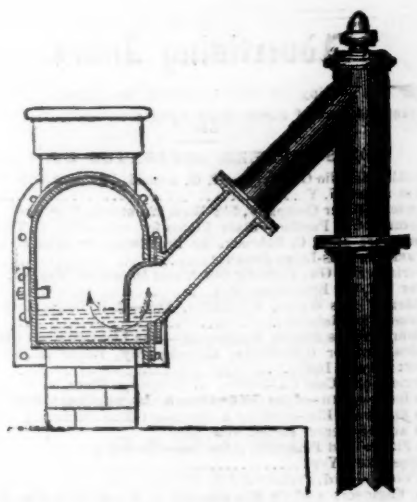

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